Subcutaneous And Mediastinal Emphysema During Dental Treatment Under General Anesthesia

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Abstract

We present a case of subcutaneous and mediastinal emphysema which occurred during prolonged dental treatment under general anesthesia, in a four year child with severe caries. We discuss the diagnosis, the investigation to rule out other probable causes, the several possible complications of using a high speed air-and-water cooled turbine dental drill and make recommendations.

INTRODUCTION

Rare complications have been reported as a consequence of dental and oral procedures ([1,2,3,4,5,6,7,8,9,10,11]). Most cases have been published in dental surgery journals (1-4) because general anesthesia was not involved. Anesthesia textbooks seldom mention the possibility of fatal complications of dental treatment, perhaps because few cases have been reported in anesthesia literature (5-6). Minor complications with a morbidity of up to 1.4% have been reported in children having short and simple dental treatments under general anesthesia ([12]).

CASE REPORT

A four year old child, ASA class I, was scheduled for dental treatment under general anesthesia due to severe dental damage caused by poor dietary habits. On the morning of the procedure the child was re-examined by the anesthesiologist and pre-medicated with a suppository of sodium thiopentone (30 milligrams per kilogram) in the operating room of the dental outpatient clinic of the hospital. General anesthesia by mask (coaxial circuit) with halothane was begun after the child was adequately sedated. Monitors applied included a pulse oximeter, an E.C.G. monitor, an automatic non-invasive blood pressure monitor, end tidal CO2 analyzer, a precordial stethoscope and a rectal thermometer. When the appropriate anesthetic depth was achieved a vein was cannulated and an infusion of 1/2 normal saline in 5% dextrose was started. Lidocaine jelly was applied to the right nostril and the vocal cords were sprayed with lidocaine 4% (4 milligrams per kilogram) before nasal intubation with a warmed endotracheal tube. A wrung-out wet hypo-pharyngeal pack was placed after ascertaining the proper position of the nasotracheal tube.

Two and a half hours after the start of the procedure the patient's temperature started to rise slowly. Surgical sheets were removed and a suppository of paracetamol (20 milligrams per kilogram) was administered. The temperature continued rising up to 38.5 degrees Celsius, even after external cooling measures were instituted. An arterial blood sample showed a pH 7.37, pO2 207 mmHg, pCO2 30 mmHg, bicarbonate 17.6 mmols/L, base excess of - 7.8 mmols/L, hemoglobin O2 saturation 99.7%, lactate 1.8 mmols/L, hematocrit 37%. Electrolytes and glucose were normal. It was decided to continue the procedure. Two hours later a sudden increase in the heart rate and an increase in the airway pressure from 18 to 28 cmH2O was noted. The heart sounds were distant on chest auscultation. When the anesthesiologist introduced his hand under the surgical drapes to rule out a kinked endotracheal tube subcutaneous emphysema was found. Immediately the surgical drapes were removed, 100% oxygen was given, mechanical ventilation was stopped and the patient was ventilated by hand at low pressures, allowing the patient to resume spontaneous breathing. The chest was expanding symmetrically and there were no wheezes, rales or differences in air entry between the two lungs. The subcutaneous emphysema was worst in the neck area and the right side of the face, less evident in the chest but palpable at the axillae, ventricular bigeminy was noted on E.C.G and was controlled with lidocaine intravenously. As it was impossible to bring a portable X-ray machine to the dental

operating room, the anesthesiologist called to the central operating room for help to transport the patient immediately to the post anesthetic care unit (PACU).

In the PACU a chest x-ray including the neck area was performed showing pneumomediastinum, subcutaneous emphysema of the neck and chest, but no pneumothorax or signs of any other pathology . Although the origin of the emphysema was suspected to be of dental origin, it was felt necessary to rule out a possible traumatic lesion in the nasopharynx or the area of the pyriform fossa caused by the tip of the endotracheal tube during intubation, or a lesion in the trachea. After an ENT surgeon was consulted, the child was scheduled for an urgent direct laryngoscopy and rigid bronchoscopy. The only finding was mild edema of the supraglottic area caused most probably by the prolonged packing of the hypopharynx. The child was returned to the PACU where antibiotic treatment with cefuroxime was started. Later, the patient was extubated, remaining in the unit for observation overnight. The morning after, when the chest film showed less mediastinal emphysema, the child was sent to the ward from which he was discharged home two days later with no further complications.

DISCUSSION

The incidence of fever in children under general anesthesia is 50% and is not related to the number of dental procedures, type of treatment, patient's weight, prophylactic antibiotics or changes of temperature during the procedure ([13]). Bacteremia occurs in up to 80% of dental extractions, 20-24% when brushing the teeth or using oral irrigation devices, and in 16% of nasotracheal intubations ([14]). Positive blood cultures (alpha-hemolytic streptococcus, corynebacteria, anaerobic diphteroids, brevibacterium, bacteroides melaninogenicus, hemophylus parainfluenzae and micrococcus) have been reported in 2/3 of children during dental extractions under general anesthesia ([15]). Antibiotics are not used routinely.

Although fever is a frequent finding following dental treatment and was managed accordingly, subcutaneous emphysema with increased airway pressure are alarming signs of barotrauma in ventilated patient and was immediately considered despite no malfunction of the equipment or any other evidence pointing in that direction. Our patient did not have any history of respiratory disease or underlying pathology. The airway pressure was kept under 20 cmH2O throughout the anesthesia and until the tachycardia and emphysema appeared. There were no pneumothorax or radiological signs of pulmonary interstitial emphysema ([16,17]). In patients ventilated in a medical intensive care unit, Petersen and Baier found that when the inspiratory pressures were above 70 cmH2O the patients had a 43% chance of barotrauma. The risks were reduced to 8% when pressures were between 50 and 70 cmH2O, and when peak inspiratory pressures were under 50 cmH2O the risk was nil ([18]). Pollak et al. has reported barotrauma to be associated with severe respiratory disease, high respiratory rate, high PEEP or peak pressures in mechanically ventilated children ([19]). The decision to avoid a chest drain was based on the presence of breath sounds bilaterally, good chest expansion, no wheezing or rales and no drop in the O2 saturation. A possible false tract in the nasopharynx or tracheal laceration caused during the nasal intubation as other etiological explanations were ruled out by the eyes-nose-throat surgeon.

In our opinion, the most likely explanation consisted in the injection of air with the high speed dental drill through the soft tissue adjacent to the roots of the inferior molars, that communicate directly with the sublingual and submandibular spaces. These communicate with the pterygomandibular, parapharyngeal and retropharyngeal spaces, the later with the mediastinum (11). The beginning of the tachycardia and appearance of subcutaneous emphysema correlated with the drilling of the right inferior molars, which led us to believe that the high speed air-and-water cooled turbine drill was the cause of the emphysema . We think there is enough evidence in the medical literature to support this as the most probable etiology (5, 9-11). Surgical procedures or extraction of lower molars, especially the third inferior molar, predispose to the development of emphysema (1) and even fatal air embolism (7) when air-and-water cooled turbine dental drills or air-water syringes are used. Pressures may exceed 2.2 KPa (16.72 mmHg) and 1.6 KPa (12.16 mmHg) respectively (1, 5). The injection of air under pressure during dental treatment with these devices has also been associated with complications such as pneumoparotis, otalgia, pneumomediastinum, pneumothorax, pneumoperitoneum, cellulitis, descending necrotizing mediastinitis and Lemierre's syndrome (8-11).

To conclude, we concur in not giving routine antibiotic treatment to the children going through dental treatments under general anesthesia except in those with a cardiac indication. In cases like this, when foreign material is introduced to subcutaneous tissue or mediastinum, wide spectrum antibiotics which cover the nasopharyngeal flora

should be used in order to avoid cellulitis, mediastinitis, or mediastinal abcesses (1,9-11). Aggressive treatment with invasive methods to drain mediastinal air is not recommended, unless there is cardiovascular compromise ([20], [21]). Finally, anesthesiologists should be aware of the severe complications associated with high speed air-and-water cooled turbine drills and air-water syringes when used in dental treatments and remember that subcutaneous emphysema does not always equal chest drain.

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